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Realizing Ecocooperation Transformation through Eco Enzyme: Turning Waste into Benefit

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ABSTRACT

This study focuses on enhancing agricultural productivity through sustainable resource management, community empowerment, and local innovation in the form of eco enzyme production by the Sumber Rezeki Women Farmers' Group (KWT). Conventional farming practices and a lack of innovation often hinder productivity. This research aims to increase productivity and community self-reliance by transforming organic waste into eco enzyme, aligning with global trends in social group strengthening and sustainable agriculture innovation. Using the Community-Based Research (CBR) approach, the study followed four stages: foundation, planning, data collection and analysis, and action. Data were gathered through observation, interviews, documentation, and focus group discussions, and analyzed using the Miles and Huberman model. The results revealed three key findings: 1) mentoring in eco enzyme production improved members' skills and knowledge; 2) the program's success was supported by sustainability commitment, local wisdom-based solidarity, and innovation-driven self-reliance; 3) the cooperation of these elements forms the concept of Ecocooperation Transformation, which enhances productivity while strengthening community resilience. This study contributes to the literature on local innovation and community empowerment in sustainable agriculture and offers a replicable model of Ecocooperation Transformation for other communities. In conclusion, collaboration, local innovation, and community strengthening are essential to achieving sustainable agricultural productivity and self-sufficiency.

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INTRODUCTION

Women's empowerment through the agricultural sector has long been a crucial component of economic and social development efforts in various regions (Rahman et al., 2024; Sunu, 2024; Yuniriyanti et al., 2020). One form of this empowerment can be seen through KWT (Kelompok Wanita Tani or Women Farmers' Group) initiatives, which provide space for women to actively participate in agriculture-based economic activities (Alfayanti et al., 2021; Sari, 2021). In Indonesia, various KWTs have emerged as efforts to improve household welfare while supporting agricultural sustainability in innovative and productive ways (Evendi & Suryadharma, 2020; Luthfitah et al., 2023; Wahyuni et al., 2022). The strategic role of KWT extends beyond agricultural production to encompass the management of local resources, the utilization of organic waste, and the development of value-added products. Through a participatory and community-based approach, KWT serves as a collective learning platform for its members, strengthens social networks, and fosters the emergence of locally relevant innovations aligned with community needs. Additionally, women's involvement in KWT activities has been proven to enhance their self-confidence and bargaining power in decision-making at both the family and community levels (Sufra et al., 2024). Thus, women's empowerment through

KWT not only impacts income growth but also serves as a vehicle for sustainable social transformation.

KWT plays a strategic role in empowering women and enhancing food security at the local level (Budiyanto et al., 2022; Nugroho et al., 2022; Yanfika et al., 2023). One example of a successful KWT initiative is the KWT Sumber Rezeki located in Sawahan Timur Village, Padang Timur District, Padang City. Since its establishment in 2020, this group has been actively involved in various agricultural activities, including planting seeds, maintaining crops, and harvesting agricultural products such as vegetables and medicinal plants. Additionally, KWT Sumber Rezeki has developed value-added products, such as ginger drink powder, which is registered with BPOM (Badan Pengawas Obat dan Makanan or the Indonesian Food and Drug Authority). Despite achieving satisfactory results, this KWT still faces challenges in optimizing agricultural production.

One of the main issues faced by this KWT is the high cost of purchasing fertilizers, which is highly dependent on market price fluctuations. The fertilizers used by KWT Sumber Rezeki are proven to be expensive and unstable in price. Meanwhile, the need for sufficient fertilizers to support plant growth is crucial. Without adequate fertilizers, plant growth will be suboptimal, ultimately reducing crop yields and lowering the overall effectiveness of farming operations. In addition to fertilizer issues, KWT Sumber Rezeki also frequently faces pest attacks that worsen the quality and quantity of their agricultural yields. Uncontrolled pest attacks can prevent plants from growing optimally, even causing significant losses. Therefore, finding more efficient and environmentally friendly solutions has become an urgent need for the sustainability and progress of this KWT.

One solution that can help address this problem is the use of organic waste to produce eco-enzymes. Eco enzymes are fermented liquids made from organic waste, such as food scraps and other natural materials (Harsono et al., 2024; Marmi et al., 2022; Utpalasari & Dahliana, 2020; Septiani et al., 2021). Eco enzymes offer numerous benefits, including serving as a natural fertilizer that can replace the use of expensive eco-farming fertilizers (Cahyantini & Setyawati, 2023). Additionally, eco-enzymes help improve soil fertility, prevent pest infestations (Gunawan et al., 2022; Larasati et al., 2020), and reduce reliance on harmful chemicals (Hariani et al., 2022; Nurhamidah et al., 2021). Other farmer groups in Padang City, such as KWT Gurun Laweh and KWT Andalas, have successfully implemented this technology in their agricultural activities. The use of eco-enzymes has proven effective in improving agricultural production efficiency, reducing fertilizer expenses, and enhancing overall agricultural sustainability.

Several studies have demonstrated the benefits of utilizing organic waste in fertilizer production. Nugraha (2016) examined the empowerment of farmers in organic fertilizer production to reduce dependence on chemical fertilizers and support environmentally friendly agricultural practices. This study demonstrates that training in the production of liquid organic fertilizer can enhance farmers' awareness of the importance of sustainable agriculture, reduce chemical use, and improve soil structure. Nurhamidah et al. (2021) examined the management of organic waste through the production of eco-enzymes at the household level as an effort to support environmental sustainability. This study demonstrates that training in eco-enzyme production can increase public awareness of waste management and introduce environmentally friendly alternatives, thereby enhancing sustainability in daily life. Vama and Cherekar (2020) focused on environmentally friendly waste management, with an emphasis on producing eco-enzymes from citrus fruit waste. This study examined the application of eco-enzymes in an environmentally friendly context, as well as the benefits of recycling kitchen waste to mitigate food waste and greenhouse gas emissions. The method used involved fermenting orange peels, water, and brown sugar, which were incubated for three months with stirring and testing of enzyme activity, such as protease, amylase, and lipase. The research results indicate that the produced eco-enzymes contain flavonoids, alkaloids, quinones, and

saponins, and are effective for various applications, including household cleaning and gardening. This study promotes sustainable practices that can reduce food waste and greenhouse gas emissions while offering practical environmentally friendly solutions. Abidin and Rohman (2020) also demonstrate that empowering farmers to produce organic fertilizer from household waste can mitigate the environmental impact of conventional agricultural practices. Additionally, Nurliah et al. (2022) state that managing organic waste through eco-enzyme production is not only effective in reducing household waste but also provides economic benefits for families, particularly through the use of eco-enzymes as cleaners and organic fertilizers.

Based on these research findings, the utilization of organic waste as fertilizer in agricultural activities by KWT Sumber Rezeki is a strategic step to address various challenges faced by the group while enhancing the sustainability of their agriculture. The implementation of eco-enzyme technology enables KWT Sumber Rezeki to overcome fertilizer cost constraints and pest infestations that hinder agricultural productivity. Additionally, the use of organic waste to produce eco-enzymes aligns with the principles of environmentally friendly and sustainable agriculture. Therefore, this study aims to examine how KWT Sumber Rezeki can build capacity in managing organic waste into eco-enzymes. This research is expected not only to provide practical solutions to the challenges faced by KWT Sumber Rezeki but also to contribute to women's empowerment, environmental sustainability, and local economic improvement.

METHOD

This study adopts a transformative approach that focuses on promoting positive change in society through the Community-Based Research (CBR) model. This approach emphasizes the importance of collaboration between researchers and communities, as well as community empowerment in finding solutions to the problems they face (Ramadani et al., 2024; Bagaskoro et al., 2023; Hanafi, 2015; Muliawan & Falasifah, 2024). In this study, KWT Sumber Rezeki is the primary focus because it faces various challenges in optimizing its agricultural yields. Therefore, this study aims to explore the potential of utilizing organic waste as a solution to reduce dependence on expensive fertilizers while addressing pest problems that frequently attack crops (Rodríguez-Espinosa et al., 2023; Sharma et al., 2019; Wislim et al., 2025; Widjanarko et al., 2025).

As a form of change-oriented research, the CBR approach requires researchers to be directly involved in community life (Ramadani et al., 2024; Muliawan & Falasifah, 2024). This involvement begins with understanding the knowledge already possessed by the community, followed by collaborating to develop existing potential. In this context, researchers do not merely act as observers but also as partners in the empowerment process (Ramadani et al., 2024; Bagaskoro et al., 2023; Hanafi, 2015; Muliawan & Falasifah, 2024). Through intensive interaction with community members (Pratama et al., 2023), this research is expected to have a tangible impact, both in terms of enhancing community capacity and improving agricultural productivity.

The implementation of this research follows the CBR stages, beginning with problem identification through discussions and direct observations in the field. At this stage, researchers aim to comprehend the challenges faced by KWT Sumber Rezeki, particularly in the areas of agriculture and organic waste utilization. Following this, the research proceeds to the stage of formulating shared objectives, where the community is involved in setting the direction and targets of the research. One of the primary objectives agreed upon is the optimization of organic waste utilization for eco-enzyme production, an effort to enhance sustainable agricultural productivity.

After the common goals were established, the research entered the stage of designing and implementing the program in a participatory manner. At this stage, community members were involved in every process, from training and testing to the production of eco-enzymes. To obtain

comprehensive data, this research used various data collection techniques, including in-depth interviews, focus group discussions, participatory observation, and documentation. All data obtained were analyzed using a qualitative approach through thematic analysis to identify patterns and meanings relevant to the research objectives.

Additionally, reflection and joint evaluation were integral components of this research. The results obtained were then discussed with the community to assess the program's effectiveness and identify sustainability strategies to ensure that the introduced innovations can be continued independently. Thus, this research not only provides practical solutions for the KWT Sumber Rezeki community but also contributes to building their capacity to implement more environmentally friendly and sustainable agricultural innovations. The research flowchart is presented in Figure 1.



Figure 1. Research Flowchart

RESULTS AND DISCUSSION

This study focuses on how mentoring is an important element in enhancing the skills and knowledge of group members, particularly in processing organic waste into valuable products, such as eco-enzymes. Through the mentoring process, KWT members who initially had no experience or knowledge in organic waste management developed into skilled and independent individuals who could utilize waste into something useful. This study employs a Community-Based Research (CBR) approach that focuses on empowering KWT Sumber Rezeki to build capacity in managing organic waste into eco-enzymes. This approach positions researchers as part of the community, directly involved in finding collaborative solutions. The mentoring process is carried out through several interconnected stages. The first step in this mentoring process is to build trust between the researcher and the stakeholders involved and to determine the role of each stakeholder. This process begins with stakeholder mapping, which involves various parties, including the village head, women farmers' groups, the Andalas Sepakat waste bank, and the university (facilitator), as shown in Table 1.

Table 1. Stakeholder Mapping

Stakeholder	KWT Members	Village Head	Andalas Sepakat Waste Bank	University
Initiator	✓✓✓✓✓	✓✓✓	✓✓✓	✓✓✓✓✓
Planner	✓✓✓✓✓	✓✓	✓✓	✓✓✓✓✓
Implementer	✓✓✓✓✓	✓	✓	✓✓✓✓✓
Facilitator	✓✓✓✓✓	✓	✓	✓✓✓✓✓
Mediator	✓✓✓✓✓	✓✓	✓✓✓✓✓	✓✓✓✓✓
Evaluator	✓✓✓✓✓	✓✓	✓✓	✓✓✓✓✓

In the assistance process at KWT Sumber Rezeki, after mapping stakeholders to understand the roles and influences of each party involved, the next activity was to determine the root causes of the problems faced by the group. This process was carried out through a focused group discussion (FGD) involving ten active members of KWT. The FGD was conducted internally, involving only group members and excluding external parties, to delve deeply into the problems directly experienced by the members. The results of this discussion were then mapped using a problem identification presented in Table 2, which recorded ten different issues faced by the group in their agricultural activities. However, among these various issues, the group collectively agreed that the primary focus

that needed to be addressed immediately was the low agricultural productivity. This issue was considered the most critical because it directly impacts the economic well-being of the members and serves as the root cause of various other related issues, such as low income, lack of motivation in farming, and limited market access.

Table 2. Problem identification process

Mapping I	Mapping II	Mapping III	Mapping IV	Mapping V
Plants are not growing well	Pests	Pests	Pests	Low agricultural productivity
Pests	Low agricultural productivity	Low agricultural productivity	Low agricultural productivity	
Holes in leaves	Lack of agricultural knowledge	Lack of agricultural knowledge		
Lack of fertilizer	Lack of fertilizer	Expensive fertilizer		
Expensive fertilizer	Expensive fertilizer			
Poor land management	Holes in leaves			
Weeds	Weeds			
Lack of agricultural knowledge				
Damage by insects				
Limited number of plants				

Next, a problem tree was developed to identify the factors causing the problem, followed by the creation of a wish tree to determine the direction of the intervention needed. The entire process referred to the Logical Framework Approach (LFA), which helped to design the intervention in a systematic and evidence-based manner.

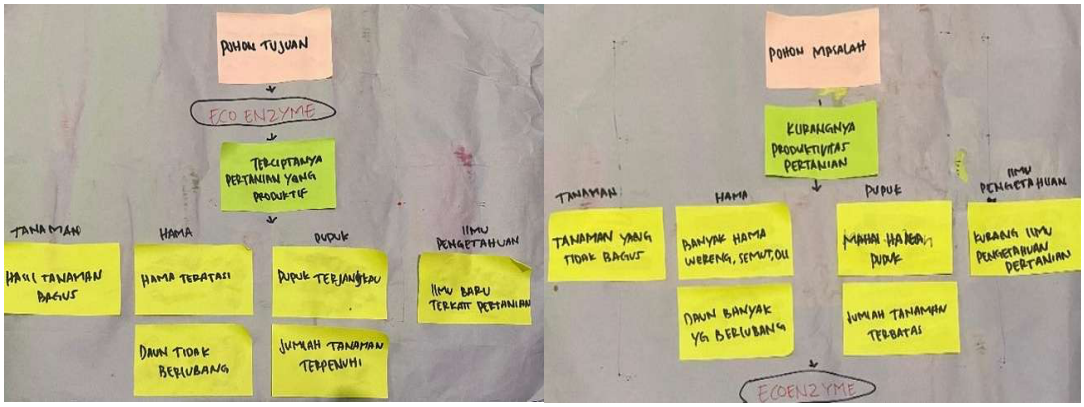


Figure 2. Identification of Core Problem

Once trust has been established and the main issues have been identified, the next step is to design a strategy for utilizing organic waste as a solution to increase agricultural productivity. At this stage, the focus of the assistance is determined collaboratively with stakeholders and the assisted groups, ensuring that the interventions carried out are in line with their needs. To support the formulation of an appropriate strategy, data is collected using relevant methods so that the issues can be understood in greater depth. The results of this data collection are then analyzed to produce an effective strategy for managing organic waste into a valuable resource for agriculture.

Furthermore, to identify the impact of organic waste utilization, the SOAR (Strengths, Opportunities, Aspirations, and Results) approach is used. Through this approach, as presented in Figure 3, the strengths of the assisted groups in processing organic waste can be explored in greater depth. Additionally, opportunities to enhance agricultural productivity through optimal utilization of organic waste management are identified. The aspirations and expectations of the target group regarding the desired outcomes are also taken into account when developing intervention strategies. Thus, the expected outcomes of this program can be designed more precisely and serve as indicators of the success of the implemented interventions.

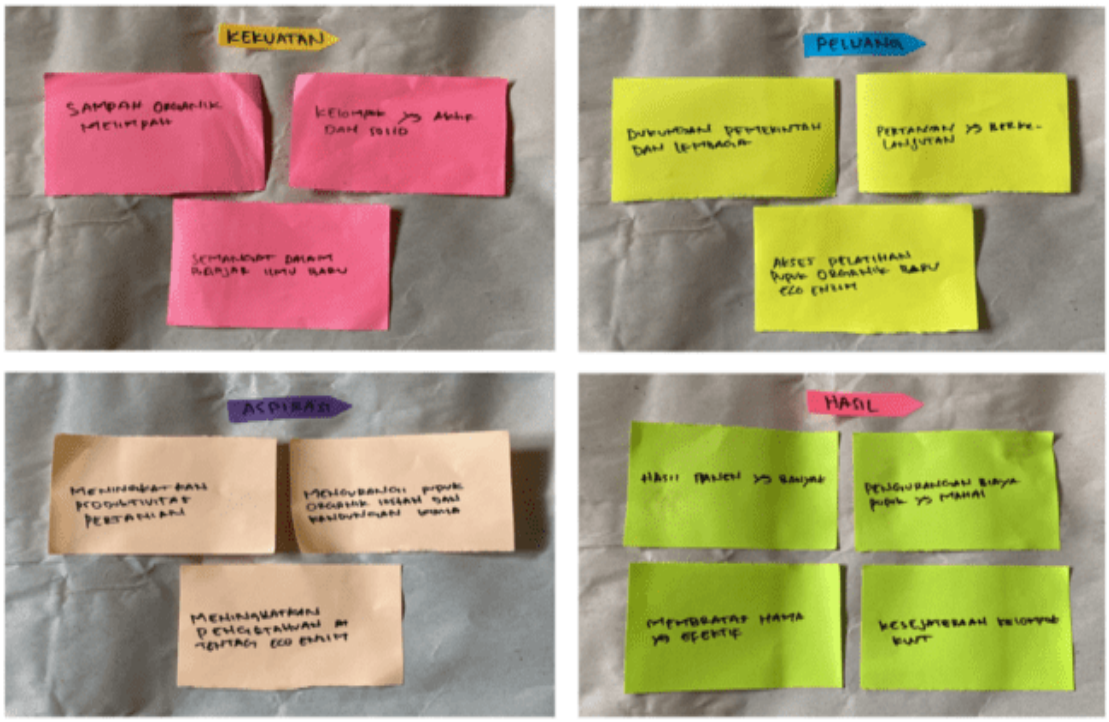


Figure 3. Brainstorming

The final stage of this assistance process involves implementing solutions, specifically the processing of organic waste into eco-enzymes, as a means to enhance agricultural productivity. The first step in this implementation is to raise awareness among the assisted groups about the benefits and importance of ecoenzymes for agriculture. Once a basic understanding has been established, training and hands-on practice in making eco-enzymes are conducted, so that the assisted groups not only understand the theory but also acquire the skills to process organic waste independently. During this process, monitoring is conducted to ensure that the production and application of eco-enzymes are progressing smoothly. After undergoing a sufficient fermentation process, the eco-enzymes, which are ready for harvest, are evaluated for their potential use in agricultural practices.

Eco enzyme first month May 28 2024



Sumber: Dokumen Pribadi

Eco enzyme second month June 28 2024



Sumber: Dokumen Pribadi

Eco enzyme last month is July 28 2024



Figure 4. Monitoring Eco-Enzymes

Through this systematic approach, it is hoped that KWT can optimally and sustainably utilize organic waste to increase agricultural productivity. Not only does this solve the waste problem, but it also opens up new opportunities for KWT to adopt environmentally friendly technologies that support food security and the sustainability of their agricultural ecosystems. The transformation that occurred in the assistance provided to the KWT Sumber Rezeki in managing organic waste into eco-enzymes shows that the changes created were not only technical, but also social and ecological. This process was rooted in the active involvement of members, the strengthening of local knowledge, and a focus on sustainability. The results of the study demonstrate that the Community-Based Research (CBR) assistance model is an effective means of fostering consistent participation, disseminating practical knowledge based on experience, and encouraging group independence in managing resources sustainably.

The phenomenon of consistent participation in KWT, reflected in the full involvement of members during eight FGD sessions, demonstrates a sense of ownership and collective responsibility for the program. This stable involvement aligns with Likert's (1932) concept of participation, which emphasizes the importance of member involvement in decision-making to enhance effectiveness and motivation. This theoretical support aligns with Haldane et al. (2019) and Samaddar et al. (2021), who demonstrate that active and meaningful community participation not only enhances program success but also empowers members and ensures the sustainability of activities. In the context of KWT, the research results reinforce this view because the genuine participation of members leads to strong solidarity, an even distribution of work, and a collective spirit that maintains the program's continuity.

In addition to participation, this study also found that local knowledge plays a major role in supporting the transformation process. The skills of KWT members in processing organic waste into ecological enzymes were acquired not only through formal training but mainly through direct practice and daily social interactions. This pattern is consistent with Polanyi's (2009) concept of tacit knowledge, which emphasizes that most knowledge is implicit and grows through experience. These findings resonate with Chen (2024) and Rao et al. (2023) that tacit knowledge transfer occurs effectively when supported by social interaction, trust, and community solidarity. Previous studies (Lemos & Joia, 2012; Xu et al., 2022; Sikombe & Phiri, 2019) also show that organizational factors and

social relationships strengthen the knowledge transfer process. In the case of KWT Sumber Rezeki, social solidarity among members is key to ensuring that this practical knowledge not only survives but also continues to develop collectively. The dimension of sustainability is also a prominent part of the research results. Through Elkington's (1997) Triple Bottom Line framework, the success of KWT can be seen in three aspects simultaneously. First, environmental sustainability is evident in the group's ability to reduce potentially polluting organic waste and convert it into environmentally friendly products. Second, social sustainability is reflected in close collective relationships, mutual support, and networking with other groups. Third, economic sustainability is evident in savings on fertilizer costs, increased agricultural productivity, and opportunities for commercialization of ecological enzyme products. These results demonstrate that the transformation in KWT is not based solely on one dimension, but rather balances environmental, social, and economic aspects simultaneously.

The overall dynamics can be understood through the concept of ecosynnergy, which combines ecology and cooperation. As explained by Capra (1997) in The Web of Life, ecosystems are complex networks that require dynamic balance. This is reflected in the cooperation among KWT members, who not only process waste but also foster collaboration, solidarity, and a shared awareness of sustainability. This concept intersects with Scharmer's (2009) view in Theory U, which emphasizes the importance of collective consciousness and cross-sector learning in addressing complex issues. The paradigm shift of KWT members from viewing waste as a burden to a valuable resource demonstrates a transformation of collective consciousness in line with this theory. Thus, the results of this study confirm that the success of the transformation at KWT Sumber Rezeki relies on the integration of active participation, tacit local knowledge, and multidimensional sustainability. These findings reinforce Likert's (1932) theory of participation, Polanyi's (2009) concept of tacit knowledge, and Elkington's (1997) Triple Bottom Line, while confirming that the ecosynnergy approach is a relevant framework for understanding socio-ecological cooperation in community-based empowerment.

CONCLUSION

The transformation of eco-cooperation in the KWT Sumber Rezeki mentoring program demonstrates that a collaborative and sustainable approach can be a solution to environmental and social challenges. By utilizing local resources, fostering collective awareness, and optimizing the community's role, KWT has successfully created a sustainable empowerment ecosystem. This success not only enhances agricultural productivity through the use of organic waste but also strengthens the economic and social well-being of the community. This model can serve as inspiration for other communities in developing sustainability strategies based on participation and local potential.

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